



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/624,776	07/22/2003	Karsten Wiczorek	2000.104300	6782
23720	7590	06/22/2005	EXAMINER	
WILLIAMS, MORGAN & AMERSON, P.C. 10333 RICHMOND, SUITE 1100 HOUSTON, TX 77042			NGUYEN, THANH T	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 06/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/624,776	Applicant(s) WIECZOREK ET AL.	
	Examiner Thanh T. Nguyen	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 April 2005.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9,22 and 26-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9,22 and 26-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 4/20/05 have been fully considered but they are not persuasive.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-5, 7-8 are rejected under 35 U.S.C. 102(b) as being anticipated by Ishida et al. (U.S. Patent No. 6,344,396).

Referring to figures 1a-1j, Ishida et al. teaches in claim 1, a method of forming a semiconductor device feature, the method comprising:

- providing a substrate (10), the substrate having a surface;
- depositing a first layer (12) above the surface of the substrate;
- depositing a second layer (14) of material on the first layer (12) of material;
- implanting ions (15a/15b) into said second layer of material (14') to modify a structure of the material of said second layer (see figure 1D);

after depositing the first layer (12) and the second layer (14) of material, patterning the second layer of material (14) and said first layer by photolithography to form said semiconductor device feature in said first layer (see figure 1c); and

removing said patterned second layer of material, whereby a selectivity in removing said patterned second layer is increased by the implanting of said ions (see figure 1e-1f, col. 11, lines 31-67, col. 12, lines 1-65), wherein the layer 14' has been removed). It is inherent that the implanted region would have a higher etch selectivity.

Regarding to claim 2, ions are substantially inert ions (see col. 11, lines 51-67).

Regarding to claim 3, ions are at least one of argon ions, xenon ions, germanium ions and silicon ions (see col. 11, lines 51-67).

Regarding to claim 4, the ion dose is in the range of approximately 1×10^{13} to 5×10^{15} ions/cm² (see col. 12, lines 30-40).

Regarding to claim 5, the ion energy is in the range of approximately 5-80 kev (see col. 12, lines 30-40).

Regarding to claim 7, second layer of material is comprised of an inorganic material (14, nitride is an inorganic material).

Regarding to claim 8, the material of second layer of material is one of silicon nitride and silicon reacted nitride (dielectric nitride is short for silicon nitride known in semiconductor).

Claims 1-3, 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Long et al. (U.S. Patent No. 6,153,534).

Referring to figures 1-10b, Long et al. teaches in claim 1, a method of forming a semiconductor device feature, the method comprising:

providing a substrate (204) , said substrate having a surface,

depositing a first layer (212) above the surface of the substrate;

depositing a second layer of material (250) on the first layer of material;

implanting ions (see figure 6a-6b) into said second layer of material (250) to modify a structure of the material of said second layer (see figure 1D);

after depositing the first layer (212) and the second layer (250) of material, patterning said second layer of material (250) and said first layer to form said semiconductor device feature in said first layer (see figure 7); and

removing said patterned second layer of material, whereby a selectivity in removing said patterned second layer is increased by the implanting of said ions (see figure 9a-9b, col. 6, lines 54-67, col. 7, lines 1-18), wherein the layer 250 has been removed). It is inherent that the implanted region would have a higher etch selectivity, see col. 5, lines 44-65).

Regarding to claim 2, ions are substantially inert ions (see col. 5, lines 44-57).

Regarding to claim 3, ions are at least one of argon ions, xenon ions, germanium ions and silicon ions (see col. 5, lines 44-57).

Regarding to claim 7, layer of material is comprised of an inorganic material (250, oxide is an inorganic material).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 6, 22, 26-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishida et al. (U.S. Patent No. 6,344,396) as applied to claims 1-5, 7-8 or Long et al. (U.S. Patent No. 6,153,534) as applied to claims 1-3, 7 in view of Iyer et al. (U.S. Patent No. 6,121,133).

Referring to figures 1a-1j, Ishida et al. teaches in claim 1, method of forming a semiconductor device feature, the method comprising:

Referring to figures 1a-1j, Ishida et al. teaches in claim 1, a method of forming a semiconductor device feature, the method comprising:

- providing a substrate (10), the substrate having a surface;
- depositing a first layer (12) above the surface of the substrate;
- depositing a second layer (14) of material on the first layer (12) of material;
- implanting ions (15a/15b) into said second layer of material (14') to modify a structure of the material of said second layer (see figure 1D);
- after depositing the first layer (12) and the second layer (14) of material, patterning the second layer of material (14) and said first layer by photolithography to form said semiconductor device feature in said first layer (see figure 1c); and
- removing said patterned second layer of material, whereby a selectivity in removing

Art Unit: 2813

said patterned second layer is increased by the implanting of said ions (see figure 1e-1f, col. 11, lines 31-67, col. 12, lines 1-65), wherein the layer 14' has been removed). It is inherent that the implanted region would have a higher etch selectivity.

Regarding to claim 2, ions are substantially inert ions (see col. 11, lines 51-67).

Regarding to claim 3, ions are at least one of argon ions, xenon ions, germanium ions and silicon ions (see col. 11, lines 51-67).

Regarding to claim 4, the ion dose is in the range of approximately 1×10^{13} to 5×10^{15} ions/cm² (see col. 12, lines 30-40).

Regarding to claim 5, the ion energy is in the range of approximately 5-80 kev (see col. 12, lines 30-40).

Regarding to claim 7, second layer of material is comprised of an inorganic material (14, nitride is an inorganic material).

Regarding to claim 8, the material of second layer of material is one of silicon nitride and silicon reacted nitride (dielectric nitride is short for silicon nitride known in semiconductor).

Regarding to claim 22, a method, comprising:

providing a substrate (10) having a first layer of material (12) comprised of a gate electrode (12) material above the surface of the substrate;

depositing a second layer of material (14) above said first layer of material; and

implanting ions(15a/15b) into said second layer of material (14') to modify a structure of the material of said second layer of material and thereby increase an etch selectivity of said

Art Unit: 2813

second layer of material relative to said first layer of material (see figure 1e-1f, col. 11, lines 31-67, col. 12, lines 1-65), wherein the layer 14' has been removed). It is inherent that the implanted region would have a higher etch selectivity.

Regarding to claim 26, ions comprise at least one of argon ions, xenon ions, germanium ions and silicon ions (see col. 11, lines 51-67).

Regarding to claim 27, ions are substantially inert ions (see col. 11, lines 51-67).

Regarding to claim 28, an implant energy of an ion implant process performed to implant said ions is selected such that the structure of the material comprising the second layer of material is modified substantially throughout an entire thickness of said second layer of material (see figure 1e-1f).

Regarding to claim 30, performing at least one etch process to define a feature in said first layer of material (see figures 1a).

Regarding to claim 31, performing an etching process to remove a portion of said second layer of material above said feature in said first layer of material (see figures 1b-1c, cols. 11, lines 7-30).

Referring to figures 1-10b, Long et al. teaches in claim 1, a method of forming a semiconductor device feature, the method comprising:

Referring to figures 1-10b, Long et al. teaches in claim 1, a method of forming a semiconductor device feature, the method comprising:

providing a substrate (204) , said substrate having a surface,

depositing a first layer (212) above the surface of the substrate;

Art Unit: 2813

depositing a second layer of material (250) on the first layer of material;

implanting ions (see figure 6a-6b) into said second layer of material (250) to modify a structure of the material of said second layer (see figure 1D);

after depositing the first layer (212) and the second layer (250) of material, patterning said second layer of material (250) and said first layer to form said semiconductor device feature in said first layer (see figure 7); and

removing said patterned second layer of material, whereby a selectivity in removing said patterned second layer is increased by the implanting of said ions (see figure 9a-9b, col. 6, lines 54-67, col. 7, lines 1-18), wherein the layer 250 has been removed). It is inherent that the implanted region would have a higher etch selectivity, see col. 5, lines 44-65).

Regarding to claim 2, ions are substantially inert ions (see col. 5, lines 44-57).

Regarding to claim 3, ions are at least one of argon ions, xenon ions, germanium ions and silicon ions (see col. 5, lines 44-57).

Regarding to claim 7, layer of material is comprised of an inorganic material (250, oxide is an inorganic material).

Regarding to claim 22, a method, comprising:

providing a substrate (204) having a first layer of material (212) comprised of a gate electrode material above the surface of the substrate material (212, see col. 4, lines 29-34). ;

depositing a second layer of material (250) above said first layer of material; and
implanting ions(see figure 6a-6b) into said second layer of material (250) to modify a structure of the material of said second layer of material and thereby increase an etch selectivity of said second layer of material relative to said first layer of material (see figure 9a-9b, col. 6, lines 54-

Art Unit: 2813

67, col. 7, lines 1-18), wherein the layer 250 has been removed). It is inherent that the implanted region would have a higher etch selectivity, see col. 5, lines 44-65).

Regarding to claim 26, ions comprise at least one of argon ions, xenon ions, germanium ions and silicon ions (see col. 5, lines 44-57).

Regarding to claim 27, ions are substantially inert ions (see col. 5, lines 44-57).

Regarding to claim 28, an implant energy of an ion implant process performed to implant said ions is selected such that the structure of the material comprising the second layer of material is modified substantially throughout an entire thickness of said second layer of material (see figure 6a-6b).

Regarding to claim 29, an implant energy of an ion implant process performed to implant said ions is selected such that said implanted ions are substantially located adjacent an interface between said first layer of material and said second layer of material (see figures 6a-6b).

Regarding to claim 30, performing at least one etch process to define a feature in said first layer of material (see figures 4a-4b).

Regarding to claim 31, performing an etching process to remove a portion of said second layer of material above said feature in said first layer of material (see figures 6-8).

However, the reference does not teach the second layer is an antireflective layer a dimension of the device feature in one direction is 100 nm or less.

Iyer et al. teaches a silicon nitride or silicon oxide act as an antireflective layer (see abstract).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form a silicon nitride or silicon oxide to act as an

Art Unit: 2813

antireflective layer in process of Ishida et al. or Long et al. as taught by Iyer et al. because the process would prevent reflection of light so that the ion beam can go through.

It would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to optimize the dimension of the device feature, since it has been held that where the general conditions of a claim are disclosed in the prior art (i.e.- dimension of the device feature in one direction is 100 nm or less), discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233 (CCPA 1955).

The specification contains no disclosure of either the critical nature of the claimed arrangement (i.e.- dimension of the device feature in one direction is 100 nm or less) or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen limitations or upon another variable recited in a claim, the applicant must show that the chosen limitations are critical. In re Woodruff, 919 F.2d 1575, 1578 (FED. Cir. 1990).

Response to Arguments

Applicant's arguments filed 4/20/05 have been fully considered but they are not persuasive.

Applicant contends that none of the prior art teaches or suggests after depositing the first layer (12) and the second layer of material (14), patterning the second layer of material (14) and the first layer (12) to form the semiconductor feature in the first layer (see figure 1C) in Ishida et al. and after depositing the first layer (212) and the second layer (250) of material, patterning said second layer of material (250) and said first layer to form said semiconductor device feature

Art Unit: 2813

in said first layer (see figure 7) in Long et al.. Noted that there is no sequence in the claimed invention to show that patterning the second layer and first layer of material in the same processing step.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Art Unit: 2813

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (**See MPEP 203.08**).

A handwritten signature in black ink, appearing to read 'Thanh', with a long horizontal flourish extending to the right.

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN